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PATENT

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

ATTY DOCKET NO.: 5649-275

DATE: May 1, 1997

## UTILITY PATENT APPLICATION TRANSMITTAL LETTER

BOX PATENT APPLICATION  
 ASSISTANT COMMISSIONER FOR PATENTS  
 Washington, DC 20231

Sir:

Transmitted herewith for filing is a patent application for:

Inventor(s): Ik-Soo LEE

Title: DISPLAY DEVICES HAVING ROUNDED CORNER BACKLIGHT UNIT

Enclosed are:

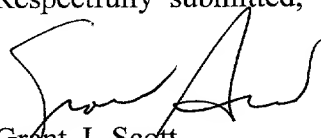
- ☒ 4 sheets of formal drawings (FIGs. 1-6)
- ☒ Declaration and Power of Attorney
- ☐ An assignment of the invention to:
- ☐ A verified statement to establish small entity status under 37 C.F.R. §§ 1.9 and 1.27
- ☐ Information Disclosure Statement, PTO-1449, and references cited
- ☐ Preliminary Amendment
- ☒ A certified copy of Korean App. 96-27918, filed July 11, 1996
- ☒ An associate power of attorney
- ☒ The filing fee has been calculated as shown below:

(Col. 1) No. Filed	(Col. 2) No. Extra	Small Entity Rate      Fee	Other Than Small Entity Rate      Fee
BASIC FEE		\$ 385	\$ 770
TOTAL CLAIMS:      15-20 = 0		x 11 = \$	x 22 = \$
INDEP CLAIMS:      4-3 = 1		x 40 = \$	x 80 = \$    80
<input type="checkbox"/> MULTIPLE Dependent Claims Presented		+130 = \$	+260 = \$
*If the difference in Column 1 is less than zero, enter "0" in Column 2		TOTAL \$	TOTAL \$    850

- ☒ A check in the amount of \$ 850.00 to cover the filing fee is enclosed.
- ☐ A check in the amount of \$ 40.00 is also enclosed to record the enclosed Assignment.
- ☐ Please charge my Deposit Account No. 16-0605 in the amount of \$\_\_\_\_\_.

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- [X] Any additional filing fees required under 37 C.F.R. § 1.16.
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- [ ] The issue fee set in 37 C.F.R. § 1.18 at or before mailing of the Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b).
- [X] Any filing fees under 37 C.F.R. § 1.16 for presentation of extra claims.

Respectfully submitted,



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I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Box Patent Application, Assistant Commissioner For Patents, Washington, DC 20231.

  
Susan E. Freedman

## DISPLAY DEVICES HAVING ROUNDED CORNER BACKLIGHT UNIT

### Field of the Invention

This invention relates to display devices, and more particularly to backlight units for display devices.

### Background of the Invention

Display devices are widely used in many consumer and commercial applications. Display devices generally use light in order to display a visible image, especially in the dark. As is well known, display devices generally include active displays in which every picture element (pixel) emits light, and passive displays which use a source of light to project through the display panel. The source of light may be supplied by a backlight unit. Examples of active displays are cathode ray tubes (CRT) and light emitting diode (LED) displays. An example of a passive display is a liquid crystal display (LCD).

A backlight unit of an LCD will now be described. Backlight units generally include a light source such as a lamp, a reflecting sheet, a light guide panel and a diffusing sheet. The backlight unit and the display panel are generally enclosed within a mold frame and a top chassis.

Figures 1, 2, 3 and 4 illustrate a conventional backlight unit of an LCD. Figure 1 is a top view of a conventional LCD module. Referring to Figure 1, the image of the LCD is displayed on the area marked with dotted lines. This area is generally called the active area, and the outside of the active area is enclosed with a top chassis 8. It is generally desirable to reduce the distance A between the top chassis 8 and the active area, in order to provide compact LCDs.

Figure 2 is a cross-sectional view illustrating a conventional LCD module. Referring to Figure 2, a conventional LCD has a light guide panel 2 which guides light to a display panel. Two diffuser sheets 3 (or diffuser and prism sheets) are mounted over the light guide panel 2. A display panel including a thin film transistor (TFT) substrate 4 and a color filter substrate 5 is mounted over these diffuser sheets. The TFT substrate 4 is connected to a PCB (Printed Circuit Board) substrate 6 having TAB IC (Tape Automated Bonding Integrated Circuit) 7. The light guide panel 2, diffuser sheets 3, TFT substrate and PCB substrate are mounted in the grooves of a mold frame 1. The mold frame 1 is combined with the top chassis 8, thereby holding and protecting the display panel and the backlight unit. Since the module size becomes smaller as the distance A is reduced, the distance B between the mold frame 1 and the active area also is generally reduced.

Figure 3 is a top view of the inside construction of a conventional backlight unit. Referring to Figure 3, the mold frame 1 is grooved so that a light source 9, the guide panel 2 and the PCB substrate 6 may be mounted thereon. The light guide panel 2 is mounted in the middle of the mold frame 1 and the lamp 9 is horizontally mounted on one side of the mold frame 1. Generally, there is some space

between the lamp 9 and the light guide panel 2 so that the light guide panel 2 can receive light from the lamp 9 and send light to the display panel. Therefore, it is possible to damage the lamp when the LCD module is shaken or external forces are imparted to the LCD module.

To solve this problem, the light guide panel 2 includes a light guide projection 10 and a side of the mold frame includes a groove 11. The light guide projection 10 of the light guide panel 2 can thus be fitted to the groove 11 so that the mold frame can fixedly hold the light guide panel 2.

Figure 4 is an enlarged diagram illustrating light concentration in a portion D of Figure 3. Referring to Figure 4, light is concentrated in the right-angled corners 10a, 10b of the light guide projection 10. When light from the lamp reaches the boundary of the light guide projection, light is partially reflected and partially transmitted to the mold frame 1. When light reaches the mold frame 1, light is reflected and is sent back to the boundary of the light guide panel 2. Then, light is partially reflected to air C and partially transmitted to the inside of the light guide panel 2. Reflection and transmission of light are repeated in air C between the light guide panel 2 and the mold frame 1, so that light may be concentrated at the corners 10a, 10b of the light guide projection 10 of the light guide panel 2.

As a result of this concentration, the light guide projection 10 of the light guide panel 2 may be brighter compared to other portions. The concentrated light may result in a poor quality LCD. Moreover, as the distance A between the module and active area is reduced, the light concentration may increase.

### Summary of the Invention

It is therefore an object of the present invention to provide improved backlight units for display devices.

5           It is another object of the present invention to provide light guide panels and backlight units which can reduce light concentration in a light guide projection thereof.

          These and other objects are provided,  
10       according to the present invention, by a backlight unit for a display device having a mold frame including a groove and having a light guide panel including a light projection mounted in the groove, wherein the mold  
15       frame groove and light guide projection each include at least one rounded corner. The rounded corner can prevent light from being concentrated at the corners of the projecting portion.

          In particular, a backlight unit for a display device includes a mold frame and a light guide panel.  
20       The mold frame includes a groove having at least one rounded corner. The light guide panel is mounted on the mold frame and includes a light guide projection mounted in the groove. The light guide projection includes at least one rounded corner corresponding to  
25       the at least one rounded corner of the mold frame groove.

          A light source is also mounted on the mold frame in spaced apart relation from the light guide panel. In this configuration, the mold frame groove  
30       and the light guide panel both include a first corner and a second corner which is remote from the light source relative to the first corner. The first corner is preferably angled and the second corner is preferably rounded. Thus, the first angled corner may  
35       effectively prevent the light guide panel from damaging the light source. The second corner may be used to reduce light concentration from the light source and

thereby improve the quality of the LCD. In other embodiments, the groove and the light guide projection are both free of all sharp angles. In other embodiments, both the first and second corners may be rounded.

The backlight unit may be combined with an array of display elements on the light guide panel, opposite the mold frame, to form a flat panel display device. A diffuser may be included between the light panel and the array of display elements. A printed circuit board may also be included on the mold frame and may include a plurality of integrated circuits which are electrically connected to the array of display elements.

Accordingly, the present invention can prevent the light source from being destroyed during movement of the LCD, by fitting the light guide projection into grooves in the mold frame. The present invention also can reduce or eliminate light concentration at portions of the LCD by rounding the corners of the projection and light guide panel.

#### Brief Description of the Drawings

Figure 1 is a top view of a conventional LCD module.

Figure 2 is a cross-sectional view illustrating a conventional LCD module.

Figure 3 is a top view of a backlight unit of a conventional LCD.

Figure 4 is a diagram illustrating a light guide projection of a light guide panel of a conventional LCD.

Figure 5 is a diagram illustrating a light guide projection of a light guide panel of an LCD in accordance with the present invention.

Figure 6 is a diagram illustrating an alternate embodiment of a light guide projection of a

light guide panel of an LCD in accordance with the present invention.

### Detailed Description of Preferred Embodiments

5 The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

10 Referring now to Figure 5, a mold frame **21** includes a concave groove **21a** in its side so that light guide projection **30** of the light guide panel **22** fits into the groove **21a**. The light guide projection **30** of the light guide panel **22** has at least one rounded corner **30b**, and the groove **21a** of the mold frame also has at least one rounded corner **21b** corresponding to the shape of the projecting portion. A pair of diffuser sheets **23** (or a diffuser sheet and a prism) having similar shape as the light guide panel **22**, are mounted on the light guide panel.

15 It is preferable to make the corner **30b** of the projected portion **30**, which is remote from the lamp **9** of Figure 3, round in order to efficiently prevent light from being concentrated. For example, when the lamp is mounted above the light guide panel **22**, the light guide projection **30** of the light guide panel **22** has an upper corner **30a** which is right-angled and a lower corner **30b** which is rounded. As shown in Figure 6, however, the projected portion **30** may have two rounded corners **30a'**, **30b**. As also shown in Figure 6,



the groove 21a and the light guide projection 30 may both be free of sharp angles.

When light from the lamp reaches the boundary of the light guide projection 30, light is partially reflected to the light guide panel and partially transmitted to the air C. Light which passes through the air layer C is again reflected to the boundary of the light guide panel when it reaches at the boundary of the mold frame. The reflection and the transmission of light are repeatedly carried out in the air C between the mold frame 21 and the light guide panel 22. Since light guide projections 30 of light guide panels in accordance with the present invention include at least one rounded corner, light which is reflected into the light guide panel 22 may be dispersed. In addition, light guide panels having at least one rounded corner can reduce the amount of light reflected into the light guide panel.

Accordingly, a backlight unit of a display device in accordance with the present invention can prevent light from being concentrated, thereby improving the quality of the LCD by rounding the light guide panel projection.

In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being set forth in the following claims.

THAT WHICH IS CLAIMED:

1. A mold frame for a display device comprising:

means for receiving a display device light source;

5 means for receiving a display device light guide; and

means for fixing the light guide, the fixing means including at least one rounded corner.

2. A mold frame according to Claim 1 wherein the fixing means comprises a groove including at least one rounded corner.

3. A mold frame according to Claim 1: wherein the fixing means includes a first corner, and a second corner which is remote from the means for receiving a display device light source  
5 relative to the first corner; and

wherein the first corner is angled and the second corner is rounded.

4. A mold frame according to Claim 2 wherein the groove is free of sharp angles.

5. A light guide panel for a display device comprising:

a light guide plate; and

a light guide projection which extends from  
5 the light guide plate, the light guide projection including at least one rounded corner.

6. A light guide panel according to Claim 5 wherein the light guide projection includes a first corner and a second corner; and

5 wherein the first corner is angled and the second corner is rounded.

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7. A light guide panel according to Claim 5 wherein the light guide projection is free of sharp angles.

8. A backlight unit for a display device comprising:

a mold frame which includes a groove having at least one rounded corner; and

5 a light guide panel mounted on the mold frame, including a light guide projection mounted in the groove and having at least one rounded corner corresponding to the at least one rounded corner of the mold frame groove.

9. A backlight unit according to Claim 8 further comprising:

a light source mounted on the mold frame, in spaced apart relation from the light guide panel;

5 wherein the mold frame groove and the light guide panel both include a first corner, and a second corner which is remote from the light source relative to the first corner; and

10 wherein the first corner is angled and the second corner is rounded.

10. A backlight unit according to Claim 8 wherein the groove and light guide projection are both free of sharp angles.

11. A flat panel display device comprising:

a mold frame which includes a groove having at least one rounded corner;

5 a light guide panel on the mold frame, including a light guide projection mounted in the groove and having at least one rounded corner

corresponding to the at least one rounded corner of the mold frame groove;

10       a light source on the mold frame, in spaced apart relation from the light guide panel; and

an array of display elements on the light guide panel, opposite the mold frame.

12. A flat panel display device according to Claim 11 further comprising a diffuser between the light guide panel and the array of display elements.

13. A flat panel display device according to Claim 12 further comprising a printed circuit board on the mold frame, the printed circuit board including a plurality of integrated circuits which are electrically  
5       connected to the array of display elements.

14. A flat panel display device according to Claim 11:

5       wherein the mold frame groove and light guide panel both include a first corner, and a second corner which is remote from the light source relative to the first corner; and

wherein the first corner is angled and the second corner is rounded.

15. A flat panel display device according to Claim 11 wherein the groove and light guide projection are both free of sharp angles.

DISPLAY DEVICES HAVING ROUNDED CORNER  
BACKLIGHT UNIT

Abstract of the Disclosure

5 A backlight unit for a display device includes a mold frame and a light guide panel. The mold frame includes a groove having at least one rounded corner. The light guide panel is on the mold frame and includes a light guide projection in the groove, having at least one rounded corner corresponding to the at least one rounded corner of the mold frame groove. By rounding at least one corner, 10 concentration of light in the display can be reduced to provide an improved quality display while still holding the light panel in the mold frame to prevent damage to the light source.

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FIG. 1

(Prior Art)

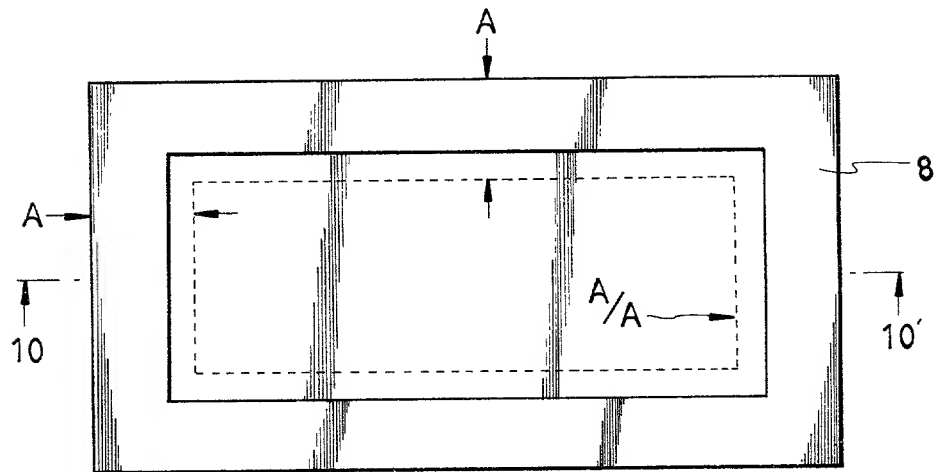


FIG. 2

(Prior Art)

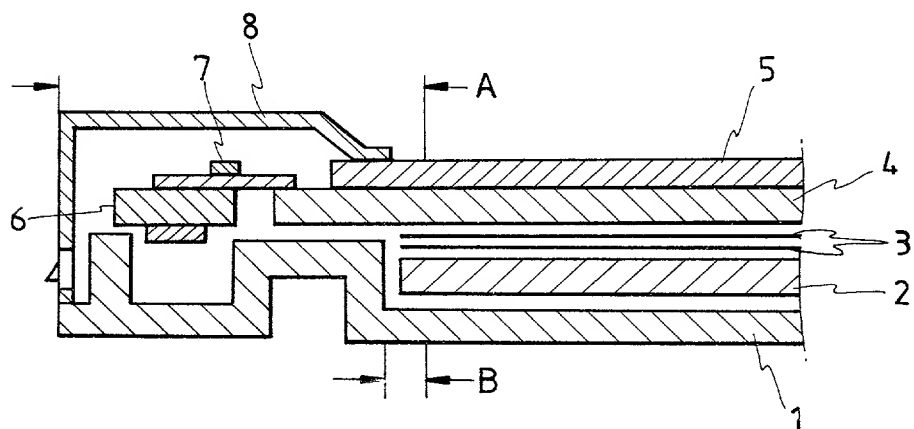
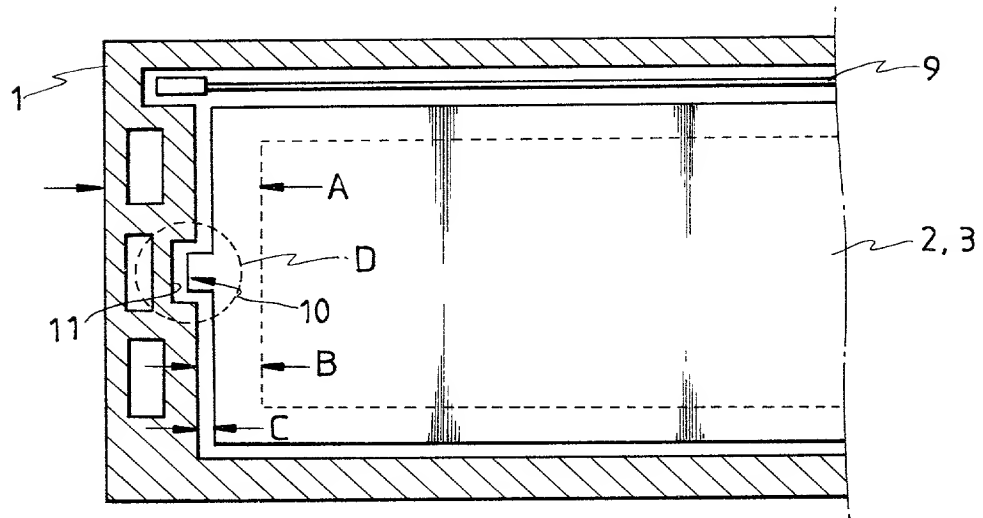


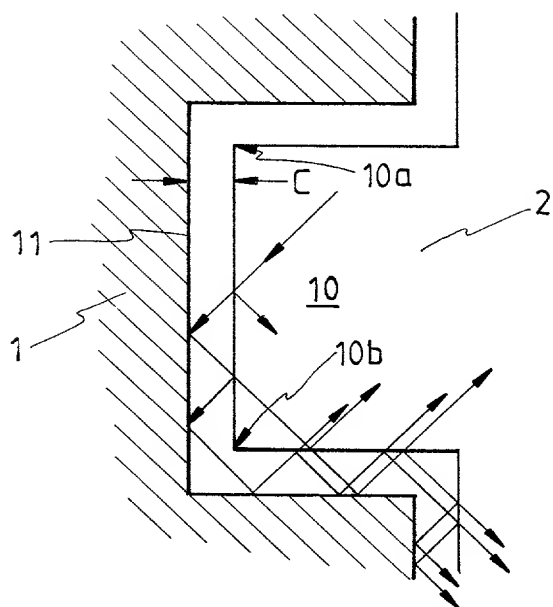
FIG. 3

(Prior Art)



**FIG.4**

(Prior Art)



**FIG.5**

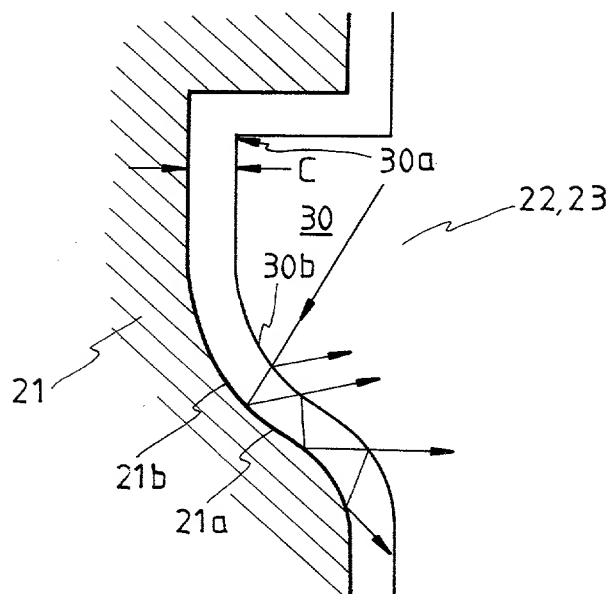
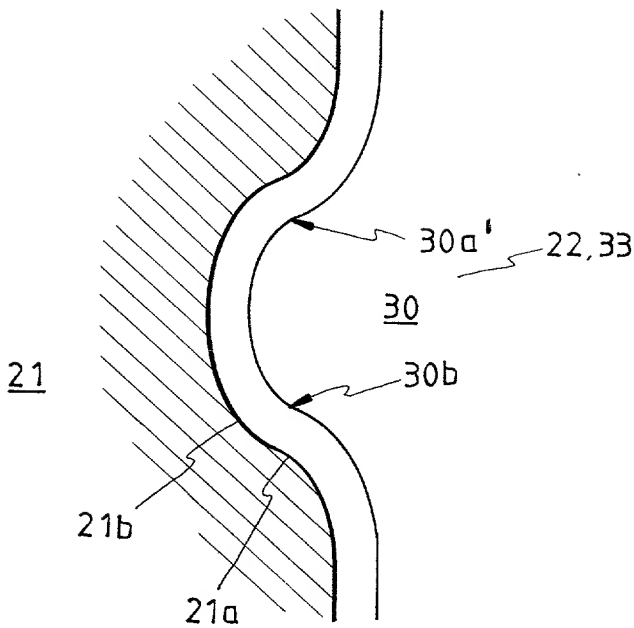




FIG. 6



# DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

Attorney Docket No. 5649-275

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **DISPLAY DEVICES HAVING ROUNDED CORNER BACKLIGHT UNIT.**

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or of any PCT International application having a filing date before that of the application on which priority is claimed.

96-27918	Korea	07/11/96	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Number	Country	MM/DD/YYYY Filed	Priority Claimed
			<input type="checkbox"/> Yes <input type="checkbox"/> No
Number	Country	MM/DD/YYYY Filed	Priority Claimed
			<input type="checkbox"/> Yes <input type="checkbox"/> No
Number	Country	MM/DD/YYYY Filed	Priority Claimed

## ENGLISH LANGUAGE DECLARATION CONTINUED

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

None	
Application Number(s)	Filing Date (MM/DD/YYYY)
Application Number(s)	Filing Date (MM/DD/YYYY)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application (37 C.F.R. § 1.63(d)).

None		
Appln. Serial No.	Filing Date	Status Patented/Pending/Abandoned
Appln. Serial No.	Filing Date	Status Patented/Pending/Abandoned
Appln. Serial No.	Filing Date	Status Patented/Pending/Abandoned

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

ENGLISH LANGUAGE DECLARATION CONTINUED

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following registered attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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43874

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Ik-Soo LEE  
Serial No.: To Be Assigned  
Filed: Concurrently Herewith  
For: DISPLAY DEVICES HAVING ROUNDED CORNER  
BACKLIGHT UNIT

May 1, 1997

Assistant Commissioner for Patents  
Washington, DC 20231

**ASSOCIATE POWER OF ATTORNEY**

Sir:

The undersigned attorney of record in this case hereby appoints the below named persons, individually and collectively, as associate attorneys to prosecute this patent application and to transact all business in the United States Patent and Trademark Office connected therewith and with the resulting patent:

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Page 2

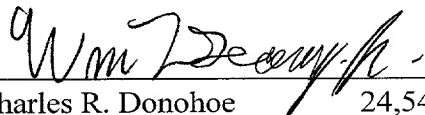
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The above-appointed associate attorneys are hereby authorized to act and rely on instructions from and communicate directly with the assignee of record and with such patent agent/attorney liaison, individual or firm, selected by the assignee, as may represent themselves to the associate attorneys as having been so appointed, unless and until I instruct the associate attorneys in writing to the contrary.

  
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Date: